Summary & Conclusion
CHAPTER V

SUMMARY AND CONCLUSIONS

In the preceding chapters introduction to the problem, development of tools, methods of study and interpretation of results were discussed. The present chapter has been devoted to the summary of the results. For providing the background of the findings, a brief description of the purpose, design and procedure, along with conclusions and suggestions for further research have been presented in the following paragraphs.

Education in the developing countries is facing numerous challenges viz: high drop out rates, low skill and knowledge levels among students, low level of engagement in schools suggest that the current paradigm of education need to be changed. For the development of basic skills and knowledge, instruction should be changed. If the students are to earn positive evaluations and to experience success in the classroom, they must demonstrate competent academic performance, including mastery of educational tasks.

• MASTERY LEARNING

No one denies that the goal of teaching is to foster learning. Mastery Learning method has exhibited its potential for maximizing attainments. It envisages that almost all students can learn all that is taught in the school. Students enter a learning situation with great many individual differences in everything from preparation in the subject, to learning style and to personality.

*Mastery Learning* is an instructional strategy based on the principle that all students can learn a set of reasonable objectives with appropriate instruction and sufficient time to learn. ML puts the techniques of tutoring and individualized instruction into a group learning situation and brings the learning strategies of successful students to nearly all the students of a given group.
John B Carroll (1963) gave the idea that student aptitudes are reflective of an individual’s learning rate. He suggested that instruction should focus more on the time required for different students to learn the same material. He called this learning rate, LR, the degree of learning, which is demonstrated in the formula:

$$LR = f \frac{\text{TimeSpent for Learning}}{\text{TimeNeeded to Learn}}$$

Carroll identified two factors that affected the learning rate of a student: **perseverance** of the student, and the **opportunity** to learn. The first is controlled by the students, that is, how much time they spend on learning, the former is the time allotted to learn by the students in the classroom, or access to materials, etc. Ability to understand instruction, time allowed & quality of instruction affected the time needed to learn. So,

$$LR = \frac{\text{Perseverance} + \text{Opportunity to Learn}}{\text{Aptitude} + \text{Quality of Instruction} + \text{Ability to Understand Instruction}}$$

However, it was Bloom in 1968, who fully developed the concepts now known as **Mastery Learning**. He concluded that if,

1. **aptitude** could predict a learner's learning rate, then he believed that it should be able to set the degree of learning expected of a student to some level of mastery performance. Then,

2. **see** to the instructional variables under an instructor's control, such as the **opportunity to learn** and the **quality of the instruction**. Thus,

3. **the** instructor should be able to ensure that each learner can attain the specified objective.

Then, the rate of learning has been presumed to be dependent upon five variables viz:

- **Perseverance**
- **Aptitude**
❖ Ability to Understand the Instruction
❖ Time allowed
❖ Quality of Instruction

The Mastery Learning model is closely aligned with the use of instructional objectives and the systematic design of instructional. Mastery Learning ensures numerous feedback loops, based on small units of well-defined, appropriately sequenced outcomes.

Components of Mastery Model are:

1. Clearly defined instructional objectives – *Defining Mastery*
2. A pre assessment of the learner's present knowledge – *Planning for Mastery*
3. An instructional component with choices and options for students - *Planning for Mastery*
4. Practice, reinforcement, frequent comprehension checks, and corrective instruction at each step to keep the learner on track – *Teaching for Mastery*
5. A post assessment to determine the extent of student mastery of the objectives - *Grading for Mastery*

Two prototypes of MLS emerged:

- Blooms Group based and Teacher paced model
- Keller’s Learner based and Individual paced model

**Blooms Mastery Learning Model**

Bloom's strategy is based on the idea that the learner is able to learn if he/she was given the enough time he/she needs to learn this task. Essentially, in Mastery Learning the task is broken down into a set of skills and sub-skills to be translated into a set of instructional objectives.
It is a Group-based teacher-paced instructional situation in which the time allowed for learning is relatively fixed. Bloom’s strategy attempts to minimize the time a student needs to learn the given material. Students learn co-operatively with their classmates and the teacher controls the delivery and flow of instruction. To provide appropriate learning conditions, Bloom (1971) outlined specific instructional strategies.

Fred Keller (1968) invented the Personalised System of Instruction, which is also called the Keller system. In 1968 Fred S. Keller, J. Gilmour Sherman, and others developed a synthesis of educational methods and practices & described the procedure, which is based upon programmed learning material, through which each student proceeds at their own pace with the goal of mastering each step. The peer tutor’s involvement is largely as a checker, tester and recorder, to ensure tutee mastery.

- go-at-your-own-pace
- unit-perfection requirement
- lectures and demonstrations for motivation
- stress on the written word for teacher-student communication
- tutoring/proctoring

Personal System of Instruction implements the presentation - performance - confirmation aspects of learning. The key factor to the success of PSI is that
mastery, not the clock or calendar determines progression on to the next topic. Goals must be clearly stated, and a proctor is available to work with students and to help the teacher with providing feedback on performance. The course is carefully divided into topics/units. At the start, the student receives a printed study material/guide to direct work on the first unit. This guide introduces the unit, states objectives, suggests study procedures and lists study questions. Before moving on to the second unit in the sequence, student must demonstrate mastery of the first by perfect/near-perfect performance on short examination. Students are examined on unit only when they feel adequately prepared. When the student demonstrates mastery of the first unit, the student receives the study guide for the next unit. Students thus move through the PSI courses at their own rates.

Therefore, Keller plan is:

- Mastery oriented.
- Individually paced courses that use
  - A few lectures to stimulate and motivate students
  - Printed study guides to communicate information
  - Student proctors to quiz evaluation and one-to-one tutoring.

**Implementing Mastery Learning Through CAI**

CAI is the use of a computer to interact directly for presenting lesson content and testing student's progress. Some of the applications of CAI are to display lesson material, provide drill and practice, reinforce learning, simulate environmental conditions display a relevant stimuli and administer tests. Computer-assisted instruction (CAI) is an interactive instructional method that uses a computer to present material, track learning, and direct the user to additional material which meets the student’s needs.

The levels of instruction between student and the computer in a CAI system are:
Summary and Conclusion

- **Drill and practice:** The computer is used to present the learner with a series of exercises, which he/she must complete by giving some response—An answer.

- **Tutorial:** All students learn in their own way and at their own pace. The student is presented with material via a dialogue in which information is presented and feedback is elicited through a process of question answer and challenge.

- **Simulation:** Both drill and practice and tutorial modes operate by providing information in a structured way, according to rules specified by tutor.

- **Modelling:** Help the student to learn by working with an analogue of a real life system or phenomenon, expressed as set of rules in the computer.

- **Interactive knowledge-based systems:** It comprises a descriptive model of knowledge relating to a particular topic, system or situation.

- **Information seeking:** The power of computer to store, retrieve and process information is used to help the student as he/she browses through the material, responding to questions about related information, retrieving items needed and summarizing statistical data.

CAI is useful because it ensures:

- Flexibility for students so that they can work at their own speed at the time that is best for them. With web-based instruction, they can work at home, at school, or anywhere there is a computer with an Internet connection.

- Used with distance learning, it allows students with handicaps or learning disabilities the opportunity to learn in a less restrictive environment. Also, students who enroll in courses via CAI, including web-based classes, gain
an opportunity to learn computer skills, which benefit them in many aspects.

As a learning device, the computer has a number of outstanding possibilities to communicate, support and control other devices. As delivery medium, the development in storage devices has led to a significant impact on the use of computers in distance education programmes. The present study focuses on use of computers for implementing Mastery Learning packages.

**APPROACHES TO LEARNING**

It has found fundamental patterns in studying and learning behavior as it actually occurs within the contexts of university education. In teaching and learning, three components of student learning are identified as - presage, process and product - which interact to form a stable equilibrium. Presage include: **Student factors** such as conceptions of learning, prior knowledge, motivation, work habits, study skills, abilities, locus of control orientation, perceived self efficacy, learning style and social & cultural factors and **Teaching factors** such as conceptions of learning and teaching, teaching styles and methods, curriculum organization, task difficulty, assessment procedures, time available, freedom allowed, classroom management, resource materials and the classroom climate.

**Process factors** are the result of interaction between student and teaching presage factors and refer to the way the students handle the learning task by adopting suitable learning approaches: surface, deep and achieving. **Deep** is defined as learning approach characterized by an intention to seek the meaning of the material to elaborate and transform it. In **Surface** approach, material being studied is reproduced using routine procedures. An **Achieving** approach, in which intention is ego enhancement or excelling in organized activities and cue-seeking behaviour. **Product factors** are the outcomes of learning and are determined
mainly by the approaches to student learning. Outcomes may be categorized quantitatively, qualitatively and institutionally.

A student’s approach to learning has two components:

1. How the student approaches the task (strategy)
2. Why the student wants to approach it (motive)

Deep learning involves the critical analysis of new ideas, linking them to already known concepts and principles, and leads to understanding and long-term retention of concepts so that they can be used for problem solving in unfamiliar contexts. Deep learning promotes understanding and application for life. In contrast, surface learning is the tacit acceptance of information and memorization as isolated and unlinked facts. It leads to superficial retention of material for examinations and does not promote understanding or long-term retention of knowledge and information.

Factors Determining Approaches to Learning

- Recognition
- Conception of learning
- Context of the learning
- Learning Styles
- Level of understanding

The six elements that positively promote learning are:

- Good teaching
- Openness to students
- Freedom in learning
- Clarity in goals and standards
- Vocational relevance
- Social climate
The two elements that tend to negatively promote learning are:

- Workload
- Formal teaching methods

**Surface Processing** is characterized by two things. One is memorizing and the other is limiting the domain of activity. Its focus tends to be on completion of the task with minimum conceptual effort. Extrinsic motivation may promote more surface approaches, as part of effort to meet requirement.

**Deep Processing** is the long term learning which refers to an active process of:

- Making associations with already familiar material.
- Examining interrelationship within the new material.
- Elaborating the stimulus through further development of it.
- Connecting the new material with personal experience.
- Considering alternative interpretations.

The learner uses the new material to reconstruct the conceptual framework by seeking personal meaning in the material. It is the intrinsic motivation that can be expected to lead towards deep processing strategies.

**PERSEVERANCE**

Personality represents the sum total of traits. Depending upon these studies various factors have been discovered and persistence represent one of the variables representing these factors. **Carroll (1963)** defines persistence as the time the learner is willing to spend in learning. A student need to spend a certain amount of time to master a task and he or she spends less time than the required amount in active learning, he is not likely to master it. So, the student varies in the amount of persistence brought to a specific learning task. Persistence is regarded as a mental attitude, which arises as the result of definite environmental situation that would tend to hinder the free unfolding of a course either begun or planned by an
individual. Carroll explores the time needed for a given student to learn a given concept depends upon five factors:

- Aptitude
- Ability
- Perseverance
- Opportunity To Learn
- Quality Of Instruction

When educators and educational researchers speak of allocated time, they are referring to one of the following elements:

- **School Time** - the amount of time spent in school.
- **Classroom Time** - the amount of time spent in the classrooms within the school
- **Instructional Time** - the portion of classroom time spent teaching students particular knowledge, concepts, and skills pertaining to school subjects
- **Engaged Time, or Time-On-Task**, refers to portions of time during which students are paying attention to a learning task and attempting to learn
- **Academic Learning Time (ALT)** refers to that portion of engaged time that students spend working on tasks at an appropriate level of difficulty for them and experiencing high levels of success
- **Dead Time** - refers to periods of classroom time during which there is nothing students are expected to be doing.

Persistence is considered to be related with the various aspects as:

- Quickness, Introversion and low Verbocity (Crutcher, 1934)
- Success in school achievement (Ryans, 1938)
- With standing discomfort, feeling of adequacy, mental fluency (Thronton, 1939)
- Lesser cortical excitation (Eysenck, 1957)
Summary and Conclusion

- Initial estimates of probability of success (Feather, 1963)
- Initial behavioral outcomes (Ziemerman and Blotner, 1979)
- Frequent contact with faculty (Pascarella and Tarenzini, 1980)
- Emotional stability (Dillon, David, Eugene, 1982)
- Academic achievement (Andrew, 1987)
- Have positive coping conditions (Glasscock, Patricia Ann, 1987)
- Past and present academic performance in case of women and social support in case of males (Adams, 1988)
- Beliefs, values and attitudes about themselves (Kala, 1993)
- Ability to articulate and internalize educational goals, low level of stress and feeling of helplessness (Mason, 1995)
- Age, instructional time and learning style (Mickens, Ceasar, 1995)
- Gender (Kim Rapp, 2003)
- Background characteristics, personal resources, aspirations, completion of task (Cohen, 2004)
- Ethnicity (Hoef, 2004)
- Quality of the programme and academic experience (Ivankova, 2004)

The students must develop an understanding of the negative and positive forces that affect their persistence. Building on that understanding, each student must make plans to manage these forces so that persistence is more likely enhanced. Since goals support persistence, students must make progress towards reaching their goals. Programs must provide services of sufficient quality that students make progress. Programs must have assessment procedures that allow students to measure their own progress. These kind of assessments must be an integral part of instructional approach.

It was this idea that instigated the investigator to further the research with a design and method presented here.
SIGNIFICANCE OF THE PROBLEM

While reviewing the research literature, it was realized that considering aptitude and time spent as the predictors of learning rate can prove to be revolutionary proposal as it is assumed that all students can learn when provided with conditions appropriate to their condition. These conditions are provided through Mastery Learning strategies. The research literature reveals that Mastery Learning is highly effective in terms of student’s retention, rate of learning, attitudes and self perceptions. The studies by Whiting (1994); Yohon (1997); Lee (1998); Urban and Weinhank (1999); Giacomo (1999) and Aviles (2001) revealed that students taught through Mastery Learning strategies achieve significantly higher than those taught through conventional group learning.

The second approach to Mastery Learning is individual based – Learner paced i.e Keller’s Personalised system of instruction which has been implemented the use of computers and is termed as computer assisted instruction. This approach has also been effective resulting in high achievement rate as compared to conventional group learning in the studies by Lamb (1995); Lafronza (1997); Clawford (1998); Kuchler (1999); Chan (1999) and Brophy (1999).

The variable of Perseverance is of great significance as in Mastery Learning it is one of the variables that predicts rate of learning. The more the time spent on learning, the more is the perseverance. This variable has been selected because research studies by Tuttle (1994); Mickens (1995); Mason (1995); Van Blerkom (1996); Nora et al (1997); Fitzgerald and Young (1997); Blair and Price (1998); Fly (1999) and Byer (2002) have established that perseverance / persistence is one of the important predictors of achievement.

Another variable proposed by the study is Learning approaches. This variable has been selected because research studies by Drew and Wakins (1997); Watkins and Wong (1998); Kajic(1998); Humphreys (1998); Chin (1998); Yin
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(1999); Salikumar (1999); Chin Christine (1999); Britton (1999); Van Melle (2000); Evans, Christiana (2001) and Behrens (2001) revealed that achievement of the learners is affected due to learning approaches.

The present research is humble attempt to study the effectiveness of computer based Mastery Learning in high school Chemistry in relation to Perseverance and Learning Approach, which means implementing MLS through computers for learners with high and low perseverance and deep & surface learning approach. It was presumed that implementation is going to be individualised hence students with differences in perseverance and learning approaches are bound to take different time to accomplish the task. A teacher with a larger group situation should handle all students and must take them to completion of task, by directing remediation / enrichment or repetition as and when required.

STATEMENT OF THE PROBLEM

EFFECTIVENESS OF COMPUTER-BASED MASTERY LEARNING IN CHEMISTRY AT HIGH SCHOOL LEVEL IN RELATION TO PERSEVERANCE AND APPROACHES TO LEARNING

DELIMITATIONS

The present study was delimited with respect to the following:

- Mastery Learning packages based on only Keller's plan were administered through computers.
- The impact of Mastery Learning strategies was studied on Achievement in Science (chemistry).
- Students were equated with respect to intelligence and knowledge in computer.
The study was confined to students of class IX in Chemistry from senior secondary schools: which were situated in Batala (Gurdaspur) and were:

♦ Affiliated to CBSE.
♦ English medium.
♦ Co-educational.

OBJECTIVES

The study has been designed to attain the following objectives:

➢ To develop and validate computer-based Mastery Learning packages.

➢ To study differences among grade IX students with regard to Entry Behaviour status for cumulative score on intelligence and knowledge in computer

➢ To study effectiveness of computer-based Mastery Learning packages on achievement as compared to conventional method.

➢ To study the effectiveness of computer-based Mastery Learning packages on achievement of IX graders in relation to perseverance.

➢ To study the effectiveness of computer-based Mastery Learning packages in relation to their learning approaches.

➢ To study the interaction effects of perseverance and learning approaches on achievement through computer-based Mastery Learning packages.

HYPOTHESES

The following hypotheses were formulated and tested:

❖ **H0 1:** There will be no significant difference in the means of High, Average and Low Groups on Entry Behaviour (EB) Scores of IX grade students
Ho 2: There is no significant difference in means of three selected groups on scores of Computer Knowledge Test.

Ho 3: There will be no significant difference in the means of Standard Progressive Matrices scores.

Ho 4: There will be no difference in Perseverance scores of Mastery Learning Group and Control Group.

Ho 5: There will be no difference in Learning Approaches of Mastery Learning Group and Control Group.

Ho 6: The instructional treatment yields equal levels of learning outcomes as measured by achievement scores.

Ho 7: The Learning approaches yields equal levels of learning outcomes as measured by achievement scores.

Ho 8: The Perseverance Level yields equal levels of learning outcomes as measured by achievement scores.

Ho 9: The difference in achievement scores through different learning strategies are not qualified by different Learning Approaches:

- Ho 9.1: With MLS: Deep and Surface approach students will achieve equal gain scores.
- Ho 9.2 With CGL: Deep and Surface approach students will achieve equal gain scores.
- Ho 9.3: For Deep Approach, Achievement scores through Mastery Learning and Conventional groups are not different.
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♦ Ho 9.4: For Surface Approach, Achievement scores through Mastery Learning and Conventional groups are not different.

♦ Ho 9.5: For Mastery Learning with Deep Approach and Conventional Group with and Surface Approach Achievement scores are not different.

♦ Ho 9.6: For Mastery Learning with Surface Approach and Conventional Group with and Deep Approach Achievement scores are not different.

✈ Ho 10: The difference in achievement scores through different learning strategies are not qualified by levels of Perseverance;

♦ Ho 10.1: With MLS: High and Low Perseverance students will achieve equal gain scores.

♦ Ho 10.2 With CGL: High and Low Perseverance students will achieve equal gain scores.

♦ Ho 10.3: For High Perseverance, Achievement scores through Mastery Learning and Conventional groups are not different.

♦ Ho 10.4: For Low Perseverance, Achievement scores through Mastery Learning and Conventional groups are not different.

♦ Ho 10.5: For Mastery Learning with High Perseverance and Conventional Group with and Low Perseverance Achievement scores are not different.
Ho 10.6: For Mastery Learning with Low Perseverance and Conventional Group with High Perseverance Achievement scores are not different.

Ho 11: The difference in achievement scores through different learning approaches are not qualified by levels of Perseverance;

- Ho 11.1: For Deep Approach, Achievement scores through High and Low Perseverance are not different.

- Ho 11.2: For Surface approach, Achievement scores through High and Low Perseverance are not different.

- Ho 11.3: For High Perseverance, Achievement scores through Deep approach and Surface approach are not different.

- Ho 11.4: For Low Perseverance, Achievement scores through Deep approach and Surface approach are not different.

- Ho 11.5: For High Perseverance and Deep Approach Achievement scores are not different from Low Perseverance and Surface approach.

- Ho 11.6: For High Perseverance and Surface Approach Achievement scores are not different from Low Perseverance and Deep approach.
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- **Ho 12:** The difference in achievement scores through different learning strategies are not qualified by different Learning Approaches and Levels of Perseverance:
  - **Ho 12.1:** For Deep Approach and High Perseverance, achievement scores through Mastery Learning and Conventional groups are not different.
  - **Ho 12.2:** For Deep Approach and Low Perseverance, achievement scores through Mastery Learning and Conventional groups are not different.
  - **Ho 12.3:** For Surface approach and High Perseverance, achievement scores through Mastery Learning and Conventional groups are not different.
  - **Ho 12.4:** For Surface approach and Low Perseverance, achievement scores through Mastery Learning and Conventional groups are not different.
  - **Ho 12.5:** Achievement scores for Deep Approach and High Perseverance through Mastery Learning and Surface Approach and High Perseverance in Conventional groups are not different.
  - **Ho 12.6:** Achievement scores for Deep Approach and Low Perseverance through Mastery Learning and Surface Approach and Low Perseverance in Conventional groups are not different.
  - **Ho 12.7:** Achievement scores for Surface Approach and High Perseverance through Mastery Learning and Deep Approach and High Perseverance in Conventional groups are not different.
Ho 12.8: Achievement scores for Surface Approach and Low Perseverance through Mastery Learning and Deep Approach and Low Perseverance in Conventional groups are not different.

Ho 13: The instructional treatment will yield equal level of learning outcomes as measured by achievement scores.
- Ho 13.1: MLS 1 and MLS 2 will yield equal gain means.
- Ho 13.2: MLS 1 and MLS 2 will yield equal gain means.
- Ho 13.3: MLS 2 and CGL will yield equal gain means.

Ho 14: The Learning Approaches will yield equal level of learning outcomes as measured by achievement scores.
- Ho 13.1: MLS 1 and MLS 2 will yield equal gain means.
- Ho 13.2: MLS 1 and MLS 2 will yield equal gain means.
- Ho 13.3: MLS 2 and CGL will yield equal gain means.

Ho 15: The Perseverance will yield equal level of learning outcomes as measured by achievement scores.

Ho 16: The difference in achievement gain scores through different learning strategies are not qualified by different Learning Approaches.
- Ho 16.1: With MLS1: Deep and Surface approach students will achieve equal gain scores.
- Ho 16.2: With MLS2: Deep and Surface approach students will achieve equal gain scores.
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♦ Ho 16.3: With CGL: Deep and Surface approach students will achieve equal gain scores.

♦ Ho 16.4: For Deep Approach, Achievement gain scores through Mastery Learning 1 and Control groups are not different.

♦ Ho 16.5: For Deep Approach, Achievement gain scores through Mastery Learning 2 and Control groups are not different.

♦ Ho 16.6: For Surface approach, Achievement gain scores through Mastery Learning 1 and Control groups are not different.

♦ Ho 16.7: For Surface approach, Achievement gain scores through Mastery Learning 2 and Control groups are not different.

♦ Ho 17: The difference in achievement gain scores through different learning strategies are not qualified by levels of Perseverance;

♦ Ho 17.1: With MLS1: High and Low Perseverance students will achieve equal gain scores.

♦ Ho 17.2: With MLS2: High and Low Perseverance students will achieve equal gain scores.

♦ Ho 17.3: With CGL: High and Low Perseverance students will achieve equal gain scores.

♦ Ho 17.4: For High Perseverance, Achievement gain scores through Mastery Learning 1 and Control groups are not different.
...Summary and Conclusion

♦ Ho 17.5: For High Perseverance, Achievement gain scores through Mastery Learning and Control groups are not different.

♦ Ho 17.6: For Low Perseverance, Achievement gain scores through Mastery Learning and Control groups are not different.

♦ Ho 17.7: For Low Perseverance, Achievement gain scores through Mastery Learning and Control groups are not different.

♦ Ho 18: The difference in achievement scores through different learning approaches are not qualified by levels of Perseverance;

♦ Ho 18.1: For Deep Approach, Achievement gain scores through High and Low Perseverance are not different.

♦ Ho 18.2: For Surface approach, Achievement gain scores through High and Low Perseverance are not different.

♦ Ho 18.3: For High Perseverance, Achievement gain scores through Deep approach and Surface approach are not different.

♦ Ho 18.4: For Low Perseverance, Achievement gain scores through Deep approach and Surface approach are not different.

♦ Ho 18.5: For High Perseverance and Deep Approach Achievement scores are not different from Low Perseverance and Surface approach.
Ho 18.6: For High Perseverance and Surface Approach
Achievement scores are not different from Low
Perseverance and Deep approach.

Ho 19: The difference in achievement scores through different
learning strategies are not qualified by different Learning
Approaches and Levels of Perseverance;

- Through MLS 1
  - Ho 19.1: HP / DA students and LP / DA will achieve
equal gain means.
  - Ho 19.2: HP / SA students and LP / SA will achieve equal
gain means.
  - Ho 19.3: HP / DA students will achieve equal gain means
  as compared to HP/SA students through MLS 1.
  - Ho 19.4: LP/DA students will achieve equal gain means
    as compared to LP/SA students through MLS 1.

- Through MLS 2
  - Ho 19.5: HP / DA students and LP / DA will achieve
equal gain means.
  - Ho 19.6: HP / SA students and LP / SA will achieve equal
gain means.
  - Ho 19.7: HP / DA students will achieve equal gain means
    as compared to HP/SA students through MLS 2.
  - Ho 19.8: LP / DA students will achieve equal gain means
    as compared to LP/SA students through MLS 2.
• Through CGL
  ♦ Ho 19.9: HP / DA students and LP / DA will achieve equal gain means.
  ♦ Ho 19.10: HP / SA students and LP / SA will achieve equal gain means.
  ♦ Ho 19.11: HP / DA students will achieve equal gain means as compared to HP / SA students through CGL.
  ♦ Ho 19.12: LP / DA students will achieve equal gain means as compared to LP / SA students through CGL.

METHOD OF STUDY

Factual material or data unknown or untapped so far is essential in every study. Relevant data, adequate in quantity and quality and also reliable and valid in every respect is a must. Thus, the selection of suitable measurement is of vital importance for successful research, especially in an experimental research study of present type. Following tools were used to collect the data:

TOOLS USED

• ENTRY BEHAVIOR TEST (Developed and Validated by the Investigator). It consisted of:
  • Computer Knowledge Test
  • Prerequisite Skills

• A STUDY PROCESS QUESTIONNAIRE (Developed by Biggs). This questionnaire was used for measuring types of Learning Approaches.

• A SCALE OF PERSISTENCE (Developed by Ahuja M. & Vashisht R, 1998). This rating scale was used to measure levels of Persistence of the students.
Summary and Conclusion

- RAVENS PROGRESSIVE MATRICES (Developed and Validated by Ravens, 1960). A test on intelligence was used to match the students on levels of intelligence.

- COMPUTER BASED MASTERY LEARNING PACKAGES (Developed and Validated by the Investigator). These are based on:
  - Mastery Learning with Computers
  - Mastery Learning without Computers
  - Conventional Group Learning

- UNIT TEST: FORMATIVE TEST (Developed and Validated by the Investigator).

- CRITERION TEST: SUMMATIVE TEST (Developed and Validated by the Investigator).

The detail of each of the tool is discussed in chapter II of this report. These tools have been given vide appendices 2 I, 2II, 2III, 2IV, 2V and 2VI.

SAMPLE

The research investigation was carried out on the students of IXth grade. The students ranged between 13 – 15 years of age. The sample was selected from the representative coeducational English medium senior secondary schools located in Batala, District Gurdaspur (Punjab). The sample in the present investigation was selected at two levels:

- School Sample
- Student Sample
- School Sample: the selection of school sample for the present investigation was done from Senior Secondary Schools. Three Senior Secondary Schools were randomly chosen from a list of 10 schools located in Batala city.
• **Student Sample:** The initial student sample comprised of 572 students chosen from three randomly selected schools but 122 students dropped out at one or the other stage. Intact sections of Grade – IX were randomly selected for different experimental treatments. The final sample consisted of 450 students. 150 students were selected for Mastery Learning Strategy 1 (With Computers), 150 for Mastery Learning Strategy 1 (Without Computers) and 150 students were chosen for Conventional Group Learning.

The tests on Computer knowledge, Entry Behaviour, Raven’s Progressive Matrices, Perseverance and Approaches to Learning were administered to match the groups.

**DESIGN OF THE STUDY**

The present study was designed to investigate into the effectiveness of Computer based Mastery Learning Strategy in IX class chemistry in relation to Perseverance and Learning Approaches. For the study ANOVA of 2 X 2 X 2 and 3 X 2 X 2 factorial design were employed. 2 X 2 X 2 factorial design was employed to analyse achievement gain scores in respect of instructional strategies, levels of Perseverance and types of Learning Approaches. The instructional strategy being a treatment variable was studied at two levels: Mastery Learning Strategy and Conventional Group Learning. Perseverance and Learning Approaches were independent variables, which were used to classify the students into High and Low Perseverant and Deep and Surface Learners. Achievement gain scores was the dependable variable.

3 X 2 X 2 design was used to analyse the results with achievement gain scores of students learning in Mastery Learning Strategy 1 (with computers), Mastery Learning Strategy 2 (without computers) and Conventional Group
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Learning situations with two levels of Perseverance (High and Low) and two types of Learning Approaches (Deep and Surface).

PROCEDURE

Procedure of the investigation comprised of two main stages:

• Selecting the Sample
• Conducting the Experiment

SELECTING THE SAMPLE

The sample was selected at two levels; School Level and Student Level.

Three schools with N = 450 students were selected for conducting the Experiment

CONDUCTING THE EXPERIMENT

The experiment was conducted in five phases as presented in following paragraphs:

Phase I  Matching the groups
Phase II  Administration of Pre-Test
Phase III Implementation of Instructional Programs
Phase IV  Administration of Post-Test
Phase V   Scoring and Analysis of data

Phase I  Matching The Groups

Before implementation of Mastery Learning Strategy, the tools for matching the groups i.e. Test for Entry Behaviour, Standard Progressive Matrices and Computer Knowledge Test were administered. Entry Behaviour describes the behaviour, students must have acquired, before they can be instructed for a particular new terminal behaviour. It depicts the initial point where instruction must always begin and is different from terminal behaviour where the instruction concludes. The scores of Entry Behaviour Test, given to selected students, were
used to determine whether or not students had adequate Entry Behaviour required for the instructional treatments.

Students were also matched on intelligence to know their level of intelligence for further treatment. Computer Knowledge was also checked as it is the pre-requisite for Mastery Learning Treatment I, where the students were supposed to work on MLS with computers.

**Phase 2 Administration of Pre-Test**

Since the experiment employed a Pre-test – Post-test design, final analysis was done on achievement gain scores, in relation to Perseverance and Learning Approaches. Pre test was given to all the students of experimental and control groups. No time limit was imposed as to get an exact Pre experiment information regarding knowledge of students on topics to be taught through Mastery Learning Strategies. Scoring was done to obtain the pre-experiment information about the students.

**Phase 3 Implementation Of Instructional Program**

The investigator developed five units of Computer based instructional Package for the purpose of providing basic information and knowledge of chemistry to the sample of 450 students. The students were divided into three treatment groups considering two experimental groups and one control group.

The instructional treatment was imparted to 450 students within the intact group selection plan. Two formats of Mastery Learning viz Mastery Learning with computers and Mastery Learning without computers was incorporated into Mastery Learning Strategy by the investigator. One treatment group was taught through Mastery Learning Strategy with computers and was called as MLS 1. The second treatment group was taught through Mastery Learning Strategy without computers and was called as MLS 2. The control group was taught by their regular (Science) teacher in the conventional way. Both the MLS1 and MLS2 were taught
by investigator herself so that fine strategic differences could be taken care of. The sequence of Events for experimental groups in the classroom was as follows:

- Instructions by the investigator:
- Sitting arrangement
- Teacher activities
- Process of Instructional Treatment
- Administering Formative Tests

The sequence of Events for control group in the classroom was as follows:

- Instructions by the investigator:
- Sitting arrangement
- Teacher activities
- Process of Instructional Treatment

**Phase 4 Administration Of post-test**

After completion of all the five units, the post test was administered to all the students. Answer sheets were scored. Time limit was 1:30 hour for 70 questions.

**Phase 5 Scoring**

All the tools were scored according to their prescribed keys and data was subjected to statistical analysis.

**STATISTICAL ANALYSIS**

Following statistical techniques were employed to analyse data obtained from the experiment in order to test the hypotheses:

1. Descriptive Statistics like Mean, SD were computed wherever required.
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2. Graphical presentations were done through Bar diagrams, Line graphs, Frequency curves.
3. One way ANOVA on Entry Behaviour, SPM, Perseverance, Learning Approaches and Computer Knowledge scores was done.
4. Three way analysis of covariance to study the impact of instructional treatment on learning outcomes was employed.
5. Each significant F-ratios were followed by t-test.

MAJOR FINDINGS

In the light of the interpretation of the results of the present study, the following conclusions were drawn:

❖ RESULTS BASED ON ANALYSIS OF EB TESTING

- The three selected groups viz: Group I, Group II and Group III were not significantly different from each other on EB scores.
- The three selected groups viz: Group I, Group II and Group III were not significantly different from each other with regard to computer knowledge scores.
- Similar results were found in case of Intelligence scores. The three selected groups viz: Group I, Group II and Group III were not significantly different from each other on intelligence scores.
- The three selected groups viz: Group I, Group II and Group III were not significantly different from each other with regard to Perseverance scores.
- The three selected groups viz: Group I, Group II and Group III were not significantly different from each other on Approaches to Learning scores.
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❖ ANALYSIS ON CRITERION SCORES

- The frequency polygon on the post criterion scores appears to be unimodal and approximately bell shaped. It appears to be symmetrical about the ordinate at $X = 142.5$ for Mastery Learning 1 and Mastery Learning 2, at $X = 132.5$ for Conventional Group Learning.

- As high as 86% students of MLS 1 could reach the 60% (Gain score = 135) gain criterion mark while only 74% could reach this score from MLS2 group. From conventional group 33% could achieve the gain of 60%.

- Whereas 70% gain (Gain score = 140) could be attained by 69% from MLS1, 55% from MLS2 and only 25% could reach this score from conventional group.

- 80% (Gain score = 145) could be reached by 30% MLS 1 group, 23% MLS2 group and only 1% Conventional group.

- 90% (Gain score = 150) only 5% from MLS1 and 3% from MLS2 could gain this score.

❖ ANALYSIS ON GAIN SCORES RELATED WITH THE EXPERIMENTAL TREATMENT AND ITS IMPACT ON THE LEARNING OUTCOMES

The main objective of this investigation was to study the impact of Computer Based Mastery Learning in relation to Perseverance and Learning Approaches.

For this purpose, gain scores were analysed from two angles:

C1 2 X 2 X 2 ANOVA on gain scores of the students studying through Mastery Learning Strategy (Pooled) and Conventional Group Learning in relation to Perseverance and Learning Approaches.

C2 3 X 2 X 2 ANOVA on gain scores of the students studying through Mastery Learning Strategy 1 (with computers), Mastery Learning Strategy 2 (without
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computers) and Conventional Group Learning in relation to Perseverance and Learning Approaches

C1 2 X 2 X 2 ANALYSIS OF VARIANCE ON ACHIEVEMENT GAIN SCORES

C1.1 DESCRIPTIVE ANALYSIS (2 X 2 X 2)

- The frequency polygon on the post criterion scores appears to be unimodal and approximately bell shaped. It appears to be symmetrical about the ordinate at X = 131.5 for Mastery Learning and at X = 126.5 for Conventional Group Learning.

- As high as 86% students of MLS (Pooled) could reach the 60% (Gain score = 124). From conventional group 36% could achieve the gain of 60%.

- Whereas 70% gain (Gain score = 129) could be attained by 70% from MLS (Pooled) and only 8% could reach this score from conventional group.

- 80% (Gain score = 134) could be reached by 32% MLS (Pooled) group and only 1% Conventional group.

- 90% (Gain score = 139) only 6% from MLS (Pooled) none could gain any score from conventional group.

C1.2 MEANS AND SD's (2 X 2 X 2)

Means of Mastery Learning and Conventional Group are different from each other. The means of Mastery Learning group being higher (Mean = 131.947) than conventional group (Mean = 117.815).

C1.3 RESULTS BASED ON 2 X 2 X 2 ANOVA ON GAIN SCORES OF THE STUDENTS STUDYING THROUGH MASTERY LEARNING STRATEGY (POOLED) AND CONVENTIONAL GROUP LEARNING IN RELATION TO PERSEVERANCE AND LEARNING APPROACHES

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Summary and Conclusion

- The Mastery Learning group yields significantly higher gain mean scores than the Conventional Group.
- The students with Deep Learning Approaches and Surface Learning Approaches, achieved equal levels of gain means.
- The students with High and Low Perseverance level achieved equal levels of gain means.
- The interaction effect of Instructional Strategy and two types of learning approaches yielded significant differences in achievement gain means scores.
  - **Through CGL**, Students, with deep learning approach and surface learning approach achieved equal gain means.
  - **With Deep Approach** Students with Mastery Learning Strategy achieved higher gain means as compared to Conventional Group Learning.
  - **With Surface Approach** Students with Mastery Learning Strategy achieved higher gain means as compared to Conventional Group Learning.
  - Students with Deep Approach and studying through MLS and those with Surface Approach and studying in CGL situation were achieving higher gain means.
  - Students with Surface Approach and studying through MLS and those with Deep Approach and studying in CGL situation were achieving higher gain means.
The interaction effect of Instructional Strategy and two levels of Perseverance yielded significant differences in achievement gain means scores.

- **With MLS**, students with High Perseverance and Low Perseverance achieved equal gain means.
- **With CGL**, students with High Perseverance and Low Perseverance achieved equal gain means.
- **High Perseverance** students with MLS achieved higher gain means than those through CGL.
- **Low Perseverance** students achieved equal gain means through MLS and CGL.
- **High Perseverance** and studying through MLS and those with **Low Perseverance** and studying in CGL situation differ significantly in their gain means.
- **Low Perseverance** and studying through MLS and those with **High Perseverance** and studying in CGL situation differ significantly in their gain means.

The interaction effect of two levels of Perseverance and two types of learning approaches yielded significant differences in achievement gain means scores.

- **With Deep Approach**, students with High Perseverance did not achieve higher gain means as compared to those with Low Perseverance.
- **With Surface Approach**, High Perseverant students achieved higher gain means than those with Low Perseverance.
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- **With High Perseverance** students with Deep Approach achieved equal gain means as compared to with Surface Approach.

- **With Low Perseverance** students with Deep Approach achieved equal gain means as compared to with Surface Approach.

- **With High Perseverance and Deep Approach** students achieved higher gain means than students with **Low Perseverance and Surface Approach**.

- **With High Perseverance and Surface Approach** students achieved higher gain means than students with **Low Perseverance and Deep Approach**.

- The interaction effect of two Instructional Strategies, two levels of Perseverance and two types of learning approaches yielded significant differences in achievement gain means scores.

  - **Deep Learning Approach** and **High Perseverance** achieved higher gain means through **MLS** and than those with **CGL**.

  - **Deep Learning Approach** and **Low Perseverance** achieved higher gain means through **MLS** and than those with **CGL**.

  - **Surface Learning Approach** and **High Perseverance** achieved higher gain means through **MLS** and than those with **CGL**.

  - **Surface Learning Approach** and **High Perseverance** achieved higher gain means through **MLS** and than those with **CGL**.

  - Students with **Deep Learning Approach and High Perseverance** achieved higher gain means through **MLS** than those with **Surface Learning Approach and High Perseverance** studying through **CGL**.
**Summary and Conclusion**

- Students with **Deep Learning Approach and Low Perseverance** through MLS and **Surface Approach and Low Perseverance** in CGL achieved equal gain means.

- Students with **Surface Learning Approach and High Perseverance** achieved higher gain means through MLS as compared to **Deep Learning Approach and High Perseverance** students in CGL.

- **Deep Learning Approach and Low Perseverance** group of students achieved higher through MLS as compared to **Deep Learning Approach and Low Perseverance** in CGL.

**C2 3 X 2 X 2 ANALYSIS OF VARIANCE ON ACHIEVEMENT GAIN SCORES**

**C2.1 DESCRIPTIVE ANALYSIS (3 X 2 X 2)**

- The frequency polygon on the post criterion scores appears to be unimodal and approximately bell shaped. It appears to be symmetrical about the ordinate at \( X = 131.5 \) for Mastery Learning1 and Mastery Learning 2 and at \( X = 126.5 \) for Conventional Group Learning.

- As high as 91% students of MLS 1 could reach the 60% (Gain score = 124) gain criterion mark while only 82% could reach this score from MLS2 group. From conventional group 36% could achieve the gain of 60%.

- Whereas 70% gain (Gain score = 129) could be attained by 78% from MLS1, 62% from MLS2 and only 8% could reach this score from conventional group.

- 80% (Gain score = 134) could be reached by 30% MLS 1 group, 28% MLS2 group and only 1% Conventional group.
.....Summary and Conclusion

• 90% (Gain score = 139) only 7% from MLS1 and 5% from MLS2 could gain this score.

C 2.2 MEANS AND SD’s (3 X 2 X 2)

The Table 4.21 reveals that the Means of Mastery Learning and Conventional Group are different from each other. The means of Mastery Learning group1 being higher (Mean = 127.749, SD = 5.891) than conventional group (Mean = 117.815). the means and SD of Mastery Learning group2 is also higher (Mean = 126.644, SD = 3.0985) than conventional group (Mean = 117.815, SD = 9.4465).

C 2.3 RESULTS BASED ON 3 X 2 X 2 ANOVA ON GAIN SCORES OF THE STUDENTS STUDYING THROUGH MASTERY LEARNING STRATEGY1 (WITH COMPUTERS), MASTERY LEARNING STRATEGY2 (WITHOUT COMPUTERS) AND CONVENTIONAL GROUP LEARNING IN RELATION TO PERSEVERANCE AND LEARNING APPROACHES

• The achievement gain scores were different for groups of students learning in three different instructional situations.
  • Students of MLS1 and MLS2 did not differ significantly in their achievement gain scores.
  • Students of MLS1 differ significantly in their achievement gain scores from students in CGL.
  • Students of MLS2 and CGL did not differ significantly in their achievement gain scores.

• The students with Deep Learning Approaches and Surface Learning Approaches, achieved equal levels of gain means.

• The students with High and Low Perseverance level achieved equal levels of gain means.
Summary and Conclusion

The interaction effect of three Instructional Strategies and two types of learning approaches yielded significant differences in achievement gain means scores.

- **Through MLS1**, Students with Deep Learning Approach and Surface Learning Approach achieved equal gain means.
- **Through CGL**, Students with deep learning approach and surface learning approach achieved equal gain means.
- **Deep Approach** Students with Mastery Learning Strategy achieved higher gain means as compared to Conventional Group Learning.
  - Students with **Deep Approach** achieved equal gain means through **MLS 1 and CGL**.
  - Students with **Deep Approach** through **MLS1 and MLS2** differ significantly on gain means.
  - Students with **Deep Approach** through **MLS2 and CGL** differ significantly on gain means.
- **Surface Approach** Students with Mastery Learning Strategy achieved higher gain means as compared to Conventional Group Learning.
  - Students with **Surface Approach** with **MLS1** differ significantly on gain means from **CGL**.
  - Students with **Surface Approach** through **MLS1 and MLS2** differ significantly on gain means.
  - Students with **Surface Approach** with **MLS2** differ significantly on gain means from **CGL**.
Summary and Conclusion

The interaction effect of Instructional Strategy and two levels of Perseverance yielded significant differences in achievement gain means scores.

- **With MLS1**, students with High Perseverance and Low Perseverance achieved equal gain means.
- **With MLS2**, students with High Perseverance and Low Perseverance achieved equal gain means.
- **With CGL**, students with High Perseverance and Low Perseverance achieved equal gain means.
- **High Perseverance** students with MLS1, MLS2 and CGL differ significantly in their achieved higher gain means.
  - Students with **MLS1** achieved higher gain means than students with **CGL**.
  - Students with **MLS1** achieved higher gain means than students with **MLS2**.
  - Students with **MLS2** achieved higher gain means than students with **CGL**.
- **Low Perseverance** students achieved equal gain means through MLS and CGL.
  - Students with **MLS1** achieved equal gain means to students with **CGL**.
  - Students with **MLS1** achieved higher gain means than students with **MLS2**.
  - Students with **MLS2** achieved higher gain means than students with **CGL**.
Summary and Conclusion

The interaction effect of two levels of Perseverance and two types of learning approaches yielded significant differences in achievement gain means scores.

- **With Deep Approach**, students with High Perseverance did not achieve equal gain means as compared to those with Low Perseverance.
- **With Surface Approach**, High Perseverant students achieved higher gain means than those with Low Perseverance.
- **With High Perseverance** students with Deep Approach achieved equal gain means as compared to with Surface Approach.
- **With Low Perseverance** students with Deep Approach achieved equal gain means as compared to with Surface Approach.
- **With High Perseverance and Deep Approach** students achieved higher gain means than students with **Low Perseverance and Surface Approach**.
- **With High Perseverance and Surface Approach** students achieved higher gain means than students with **Low Perseverance and Deep Approach**.

The interaction effect of three Instructional Strategies, two levels of Perseverance and two types of learning approaches yielded significant differences in achievement gain means scores.

- **Through MLS1**
  - Students with **High Perseverance / Deep Approach** achieved higher gain means than students with **Low Perseverance / Deep Approach**.
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- Students with High Perseverance / Surface Approach achieved higher gain means than students with Low Perseverance / Surface Approach.
- Students with High Perseverance / Deep Approach did not differ on gain means from students with High Perseverance / Deep Approach.
- Students with Low Perseverance / Deep Approach achieved equal gain means to students with Low Perseverance / Surface Approach.

- Through MLS2
  - Students with High Perseverance / Deep Approach achieved higher gain means than students with Low Perseverance / Deep Approach.
  - Students with High Perseverance / Surface Approach achieved equal gain means to students with Low Perseverance / Surface Approach.
  - Students with High Perseverance / Deep Approach did not differ on achieved gain means from students with High Perseverance / Deep Approach.
  - Students with Low Perseverance / Deep Approach achieved equal gain means to students with Low Perseverance / Surface Approach.

- Through CGL
  - Students with High Perseverance / Deep Approach achieved equal gain means to students with Low Perseverance / Deep Approach.
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- Students with **High Perseverance / Surface Approach** achieved equal gain means to students with **Low Perseverance / Surface Approach**.

- Students with **High Perseverance / Deep Approach** did not differ on achieved gain means from students with **High Perseverance / Deep Approach**.

- Students with **Low Perseverance / Deep Approach** achieved higher gain means than students with **Low Perseverance / Surface Approach**.

**EDUCATIONAL IMPLICATIONS OF THE FINDINGS**

The results of the present investigation indicate that teaching students through Mastery Learning Strategies, it is better to modify Bloom’s Mastery Learning Strategy and Keller’s Personalised System of Instruction according to the need of the situation and learners. Control and flexibility, among other advantages offered to learner, lead us to propose that strategy is more effective than traditional models. Although, both these strategies are highly effective in ensuring mastery, yet, Mastery Learning Strategy with computers offers a great new possibility to improve achievement and enhance Perseverance in providing students with mastery experiences. Mastery Learning Strategy with computers can provide highly favourable instructional component needed to promote equality in educational outcomes and to encourage individuality in student learning. Quality instruction and equality of results can add to provide best and healthy experiences to children.

Experiences of success and failure have an important effects on child’s perceptions and beliefs of their abilities and their future expectations in many settings. Teachers need to provide many opportunities for learners to experience success. Educators must also look at what factors students attribute to their success.
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or failure. Mastery attainment leads to higher strides of success and success in turn enhances Perseverance and suitable Approach to Learning. Efforts should be enhanced by the teachers to enhance Perseverance and Learning Approaches, to impel or propel engagement in learning process, and to teach students through suitable strategy that can be used.

Utilization of knowledge about Entry Behaviour status for designing instruction appears to be an important direction that results of the study provide. Not only the prerequisite testing, as is done even in conventional teaching but some other background factors be identified before the teacher implements instructional plans. The results indicate that suitable Learning approach, perseverance to the task in hand, urge to complete the task, time allowed to complete the task enhances success for learners.

The outcomes of the study, which are grounded in Perseverance and Learning Approaches, revealed the importance of quality of instruction, time allowed for learning, motive for learning a task and proper use of strategy for accomplishing a task that promotes quality of learning. Similar efforts be made in different subject areas where perseverance and learning approaches other than prior knowledge in the subject be identified and used for designing and implementing instruction. It is also recommended that teachers participate in a training programme to become familiar with different strategies of Mastery Learning and their effect on achievement so that they can improve learning in any classroom.

An important finding of the investigation that MLS’s when implemented through computer have done exceptionally better than even MLS without computers. It is a very strong recommendation based on these results that strategies be employed in general to improve quality of education at any level particularly at elementary school stage when quality is the cry of the day. Even, for project MLL it was emphasized to deploy MLS for small children. Accepting
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this premise, the results may also prove to be considered at a measure against swollen attendance in class rooms of today. Mastery Learning Strategy with Computer Assisted Instruction will definitely help teachers of their burden and thus help in promoting measure devidents through education.

SUGGESIONS FOR FURTHER RESEARCH

The investigator is quite aware of the limitations under which the present investigation was conducted and therefore that no sweeping generalizations could be made. The findings are only indicative of trends and hence are to be viewed in light of following limitations.

- The sample of the children was drawn mainly from the schools having well developed computer laboratories.
- The sample was limited to only to the urban areas.
- The study was limited to only grade IX of normal children rather than on any specific group of children.
- The variables studied were limited to computer based Mastery Learning Strategy, Learning approaches and Persiverance.
- Study was conducted on both boys and girls.
- Achievement was viewed as performance in Science (Chemistry) only.

The researcher, by virtue of her experience in the field of study humbly offers the following suggestions for further research that could be taken by the perspective researchers.

- Based on the present research about computer based Mastery Learning strategy, persistence and learning approach, it is clear that computer assisted instruction seemed to be better in achieving higher gains as
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compared to control group. For further study, well designed strategy can be focused on promoting achievement even when learner seem to be low in computer knowledge, differ in levels of persistence and types of learning approaches.

- For further study, it is recommended that this research be modified at other levels of education to determine if the results of the study were influenced by other environmental factors.

- Relative interaction effect of the objectives of the study may be studied at large scale, especially for learner of higher education, with the different subject areas, having different persistence levels, and different learning approaches.

- Some experimental studies can be planned and conducted to study the effect of computer based Mastery Learning strategy in various subject areas like mathematics, physics, biology and languages.

- Findings of this study support the need for further research to involve investigations that compare levels of persistence in achievement and different learning situations across different levels of entry behaviour.

- Meta – analysis of the study in respect of computer based Mastery Learning strategies may be conducted.